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BUTTER MAKING ON THE FARM.

BY

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UNDER SUPERVISION OF THE DAIRY DIVISION,
BUREAU OF ANIMAL INDUSTRY.

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CONTENTS.

	Page.
Introduction	3
Good milk	3
Creaming the milk	4
Deep cold-setting	6
The farm separator	7
Ripening cream	8
The churn	10
Churning	10
White specks in butter	11
Coloring butter	12
Salting and working butter	12
Shall butter be worked once or twice?	13
Make butter to suit the customer	14

BUTTER MAKING ON THE FARM.

INTRODUCTION.

As a matter of course, everyone who keeps cows for the purpose of making butter is desirous of making an article that will bring the best price possible, and of making the greatest amount of butter possible out of the milk produced. When the milk is delivered to a creamery it is usually manufactured by those who have been well instructed in the art of butter making, and the result is that, as a rule, a fairly good article is made. Besides this, the creamery is equipped with appliances which enable its butter maker to obtain very nearly all the butter contained in the milk; and by his knowledge of what the general butter market demands, he is able to produce an article which is readily sold.

But the case is different with those who make butter on farms, where by far the greater part of the butter in this country is made. While on some farms excellent work is done and a choice article is made, which brings a fancy price, yet through ignorance of correct methods of manufacture and of the demands of the market and, in many instances, through careless and slovenly habits, the great bulk of farm-made butter fails to bring the price it should, entailing a loss on the farmers of the country which is enormous in the aggregate. It is for the benefit of the latter class that this article is written, with the hope that some suggestions may be given, and some ideas advanced, which will serve to improve the methods of the dairyman and increase his profits.

GOOD MILK.

To make good butter one must have good milk, and this comes only from healthy cows, fed on good, sweet pasture or on good, sweet grain and other forage, and which have pure water to drink and pure air to breathe. Certain obnoxious weeds—leeks, wild onions, rag-weed, and others—give the milk and the butter made from it a decidedly bad flavor; so also does damaged, rotten silage, moldy corn fodder or hay, and musty, damaged grain. Impure water has its effect, both on the health of the animals and on the quality of the milk. In many pastures are seen small pools in which the cows stand during the heat of

the day to rid themselves of flies. The water in these becomes filthy and is kept stirred up by the movements of the cattle, and where, as is often the case, it is the only water obtainable, the cows are compelled to drink it. This can usually be avoided by fencing the pond and keeping the cattle out. If this water is needed for the cattle it can be drawn out by a pipe laid on the lower side into a trough from which the cows can drink.

In a close, crowded, and illy ventilated stable, where there is too little air space for each animal, the air becomes foul from the exhalations, and this affects the milk as well as the health of the animals. The remedy in this case is to provide more room for the stock and better ventilation.

The stable should be kept as clean as possible and the cows well bedded and clean. The utmost cleanliness should be observed in milking. All dirt should be brushed from the cow before beginning to milk, and it is best to dampen the udder and flank of the cow, so as to prevent the dust and fine dirt from falling into the milk. The milk should be strained immediately after milking and not allowed to stand in the cow stable any longer than is absolutely necessary.

A good strainer is indispensable, and one of cloth is much better than one of wire gauze. Milk pails should always be made of tin, and the seams should be soldered smooth, so that there will be no places for the dirt to lodge where it will be difficult to remove. They, as well as all other dairy utensils, should be thoroughly cleaned every time after using. Tin articles should be washed first in cool then in hot water, and after that thoroughly scalded with boiling water or steam. They should then be dried in fresh air and, if possible, in the sunlight. They will not need wiping after the scalding, as the heat from the boiling water will cause them to dry quickly. In washing them, if hot water is used first, it will cook the milk onto the tin and make it difficult to remove.

In cleaning the butter-bowl, ladle, worker, churn, and any other wooden utensil, they should be first washed with hot water, then scalded with boiling water or steam. They should be aired, but it will not do to have them much exposed to the sun, as that will cause warping and cracking.

CREAMING THE MILK.

When good, clean milk has been secured, the next operation is to separate the cream from the body of the milk. The old way, practiced by our mothers and our grandmothers, was to set the milk in shallow pans with the milk not more than 2 or 3 inches deep. The writer of this has been through all the successive stages of dairy methods. First, we used to set our milk in common 10-quart tin pans on shelves; then we had it arranged so that in hot weather cold water flowed around the pans to keep the milk cool. After that, large shallow pans were used, each one large enough to hold a single milking of the entire herd of 25 or 30 cows. Under these pans were water channels, through which in

warm weather cold water was run, and in cold weather warm water, to regulate the temperature of the milk. Then the deep cold-setting was used in both "shot-gun" cans and Cooley cans, and finally, for the past five years, the farm separator has been used.

It is undoubtedly true that by the old method of shallow setting as good a quality of butter was made and can yet be made as is produced by any other method, but it has its drawbacks. Uniformly good results can not be obtained, for the reason that the milk, being spread out in a thin sheet, is exposed to the air, so that it is readily affected by atmospheric changes. Whatever may be the reason, very bad effects often follow an electric storm or thunder shower. The shallow pans make more work than other methods; the creaming is not so thorough as with the separator, and, therefore, the quantity of butter is less.

As there are many persons who think they are so situated as to make any other method impracticable, or who have such a deep-seated prejudice in favor of the old way that they can not be induced to change, it is thought advisable to give directions as to the best manner of proceeding, as determined by the result of long years of practical experience, although the method itself is not recommended.

Milk should be set as soon as possible after being drawn from the cow, whether shallow or deep setting is used. With open setting it must be in a room where the air is pure. A pantry with a door opening into the kitchen is a bad place. The odor from cooking vegetables and meat will surely injure the butter. Many make butter in a cellar because it is cool, but it is apt to impart a musty, moldy smell to the butter. A cellar may be good and cool, and yet be so ventilated as to have pure air; then it is all right for butter making. To get the best results with shallow setting, the temperature of the milk should not go much above 60° F. At that temperature it can usually stand about thirty-six hours. The time to skim is when the milk has soured just enough to be a little thick at the bottom of the pans and to thicken the cream. The cream can not be skimmed off when it is thin and sweet without loss. No milk should be taken with the cream. Cream with milk in it sours much more rapidly than cream with no milk in it. This cream will be very rich and thick, and, although partially ripened when taken off, if kept at a temperature of 60° or below, it will be all right if held two or three days before churning. Whenever a new skimming is put into the cream jar or can, the whole should be thoroughly stirred and mixed.

In the winter effective creaming may be had when the room in which the milk is set is very cool, even down near the freezing point. This is accomplished by heating the milk to above 100° F. before setting. The cream will rise very rapidly while the temperature is falling. The warming can be repeated after twelve hours, if the milk is in small pans, by setting over a kettle of boiling water. If large pans are used, such as have been described, the heating is done by running hot water

through the water channels beneath the milk. This practice of repeated heating and cooling makes very effective creaming, leaving but little butter-fat in the skim-milk, and the cream is rich and thick.

DEEP COLD-SETTING.

With this method, the milk is set in cans about 20 inches deep by 8 inches in diameter. It should be set in a tank of ice water as soon as possible after milking while the milk is yet warm. The most effective creaming is done when the temperature of the water is maintained at about 40° F., though fairly good work is done when the water is even up to 50° F., if it is allowed to get no higher. When there is a fountain or flowing well or running stream of water continually flowing into and out of the tank, so that the water is constantly being changed around the cans, the warm milk will be more rapidly cooled and the cream will rise more rapidly than if the water is at rest. For this reason cool springs, spring pools, and spring houses are very satisfactory, even if the water is up to 53° or 54° F.; and deep stone jars or milk crocks may be used as well as deep tin cans. It is claimed that with this mode of setting all the cream that can be obtained will be up in ten or twelve hours. This may be so, though it is doubtful. It is better to let it stand twenty-four hours, for the reason that the cream will be thicker and richer at the end of that time, though it may not measure any more, or even as much, in depth as it would when set only twelve hours.

Setting the cans in cold air will not prove nearly as effective in raising the cream as setting them in cold water, even though the temperature of the surrounding air is near the freezing point.

With the jars, crocks, and the common "shot-gun" cans, as they are called, the skimming is done by dipping the cream from the top, but with the Cooley cans and many other creamers it is done by drawing the milk off from the bottom and leaving the cream. There is a strip of glass inserted in the side of most of these cans, so that the depth of the cream can be seen. With deep cold-setting the cream is always sweet and thin, and where the skimming is done from the top it requires a great deal of skill to dip the cream off without getting some of it mixed with the milk and lost. Much more cream and, consequently, butter, is lost in this way than is even dreamed of by those who practice it. A conical or pointed dipper is the best kind of skimmer for this work. In using it insert the point of the skimmer in the middle of the can and press it down very gently till the cream slowly runs over into it. When it is filled carefully lift it out and empty it; then put it into the can in the same place it was before—that is, in the middle—and repeat the operation till the cream is all off. This work should be done very carefully, so as not to create any commotion in the milk; and even with the best of care some of the cream will get mixed with the milk and lost. Much the best way is to skim by means of a faucet,

drawing off the milk rather slowly at the bottom, so as not to create currents in the milk, and leave about one-half an inch of milk under the cream.

THE FARM SEPARATOR.

By the use of the cream separator a much more perfect separation of the cream from the milk may be had than by any system of setting milk. This is shown by the increased amount of butter made when the separator is used, and also by the amount of butter-fat left in the milk after skimming, as shown by the Babcock milk test. It has been found that by no system of gravity creaming can all the butter-fat be recovered; and usually, under ordinary conditions, a large per cent is lost; while with the separator very nearly all is recovered.

The writer has been engaged in the Farmers' Institute work in the State of Wisconsin, during each winter, for several years. At each meeting milk was tested with a Babcock tester which was carried along for the purpose. Farmers were invited to bring in samples of milk to be tested in order to show them the variation in value of different milks, and for the purpose of illustrating and explaining the working of the machine. They were especially urged to bring in samples of skim-milk—that which they thought had been thoroughly creamed—so that the audience might see what the loss was. For two years the writer preserved the report of these tests and the average of all was eight-tenths of 1 per cent for the skim-milk creamed by any gravity method. It varied from one-fourth of 1 per cent to $1\frac{6}{10}$ per cent. This was in the winter, when there was no difficulty in having the milk cold enough. There is no doubt that in summer, during hot weather, the average loss is still greater. If the separating is done on the farm immediately after the milking, the skim-milk from the separator seldom tests more than one-tenth of 1 per cent, and frequently less than that.

From the result of these tests it seems impossible to escape the conclusion that the average loss, where the milk is set in pans, cans, and crocks, is three-fourths of a pound of butter more to each 100 pounds of milk than where the separator is used. This means, with milk of average richness (3.5 per cent butter-fat), a loss of about 20 per cent of the total product of butter. A herd of cows ought to average, per cow, 5,000 pounds of milk per year, and would do so if made up of good animals and well managed; but even if they only averaged 3,000, the loss on one cow would be $22\frac{1}{2}$ pounds of butter, and on ten cows 225 pounds, which, at 20 cents a pound, would be $45 a year. It will be seen by this that the loss to the farmers, who cream their own milk by a gravity process, is enormous in the aggregate. How can any business man succeed and suffer such a percentage of loss? What would be thought of the man who would go on from year to year with a hole in his pocket through which 20 cents would drop out and be lost every time he put a dollar into his pocket. Some men try to console themselves by saying, "It is not all lost; the calves and pigs get the butter." But

this is poor consolation, for butter is dear feed, even when the price is the lowest. One cent's worth of oil-meal will do the calves and pigs as much good as a pound of butter. Besides this, the skim-milk from the separator, when it is run through and fed to them immediately after milking, while it is warm and new and sweet, is better feed for calves than skim-milk that is old and partially sour, even though it does contain one-quarter of the butter-fat originally in it. This can be attested by hundreds who are using farm separators.

The cost of hand separators is from $65 to $125 each, according to size and capacity. They will skim from 160 to 400 pounds an hour. Larger sizes with greater capacity are used in large dairies and run with some kind of a power. It would seem that no dairyman, who manufactures his own milk into butter, having ten cows or more, could afford to be without a separator. One, if properly cared for, will last for years. If they are turned by hand, it is true that takes time, but not as much time as would be taken in setting and skimming the milk and warming it for calves. All except the smallest size hand separators are so constructed that they can be attached to a power. Some use a small gasoline engine, or some other kind. A light tread power run by a large dog or some other animal of like size is very economical. A goat has been found to do remarkably well.

On the farm of the writer a separator has been run for the past five years, making an average of nearly 9,000 pounds of butter a year. The cost of repairs in that time has been $3, and the separator, to all appearance, will last for several years to come. It has a capacity of 300 pounds of milk an hour. It is run by a 2-horse tread-power, which was purchased before the separator was and which is used for cutting feed, filling silo, etc. The power is run by a Jersey bull, and works very nicely. He needs the exercise; it keeps him docile and gentle, vigorous and healthy, and he seems to enjoy the walking and work. The separating is done while the milking is going on, and ten or fifteen minutes after the last cow is milked the calves and pigs have had the new, warm, sweet skim-milk. The saving by the use of the separator on this farm has been already a great many times more than the cost of the outfit.

RIPENING CREAM.

When shallow setting has been used the cream is already ripened, or partially so, when taken off. It has been kept cool, stirred up when each skimming was added, and is ready to churn at any time when brought to the proper temperature.

A correct dairy thermometer is indispensable in butter making. Temperature plays an important part all the way through. It is necessary to know the temperature of the dairy room, the water, the milk, the cream when ripening, and, above all, the temperature of the cream at time of churning. No person can guess at temperature correctly every time; therefore, no person can make a uniform quality of

butter without using a thermometer at almost every stage of the work. Yet a cheap, unreliable thermometer is worse than none.

Cream from deep cold-setting is cold and sweet when taken off. If it is kept in a room where the temperature is about 60° F. for twenty-four to thirty-six hours it will begin to sour. Each skimming when put in the cream can should be well mixed with what was in before. No fresh cream should be put in the can for twelve to sixteen hours before churning, for if this is done the fresh cream will not be ripened and the butter will not all churn out.

Cream from the separator is warm when it is separated right after milking and has the "animal heat" still in it. It must be aërated and cooled immediately. When the cream is run into "shot-gun" cans the aëration and partial cooling may be done by pouring several times in a small stream from one can to another. A better way is to have a cream cooler, made something like a large colander, placed high above the cream can. The bottom of this cooler has a great number of very small holes through which the cream runs in tiny streams into the cream can, and in that way is thoroughly aired and partially cooled. Setting in cold water will complete the cooling. Afterwards it can be handled the same as described for cold-setting cream, except that, being fresher, this cream needs about twelve hours more time to ripen.

The way just described is practiced by a great many with excellent results; but there is a better way if one has the facilities for doing it. Keep the cream by setting in small cans in cold water, or otherwise, at a temperature of 50° F. till twelve hours before the time of churning. Then mix it all together in a vat or can and warm it up to 70° F. Then put in a "starter" and keep it nearly, if not quite, up to 70° for twelve hours, and when it is afterwards cooled to the right temperature it will be ready for churning. The starter may be some good skim-milk which has been kept at a temperature of 85° or 90° F. till it is sour and thick, or it may be some cream already ripened, or some buttermilk from the last churning. Use of the starter an amount equal to about 2 per cent in bulk of the cream; in other words, one quart of the starter to 12 gallons of cream. Another form of home-made "starter" that has been highly recommended is made as follows: Take fresh milk, secured in a perfectly clean way, from a healthy, well-fed, fresh milch cow. Set this milk in ice-water and expose only to pure air for twelve hours, or pass it through a separator, and keep the skim-milk at a temperature of 85° F., long enough to lopper. Do not disturb the coagulum until ready for use. Then skim off the top, stir it carefully, and strain through a fine mesh into the cream, in the proportion already stated.

One of the most difficult things to determine is when the cream has the proper ripeness to be churned, so that uniform results can be obtained and one churning be like another. For aid in this respect acid tests have been invented for testing the acidity of cream during

ripening "to trace the progress of its souring and show whether the fermentation should be hastened or checked in order to have the cream in a certain acid condition and ready for churning at a given time." These acid tests require experience and skill for their successful use. A skillful and experienced butter-maker is able to judge closely as to the right condition of cream for churning by its appearance. But this is a matter which it is impossible to exactly describe in words.

THE CHURN.

The best churns are those with no inside fixtures and which revolve, like the barrel churn, square-box churn, rectangular churn, etc. These "bring" the butter by the concussion of the cream in falling from one side to the other as the churn is revolved. A quite common mistake is to get too small a churn. It should never be filled more than half full of cream. One-third full is better, because the cream has a better chance to fall. Before putting in the cream the churn should be scalded with hot water and then rinsed with cold water.

CHURNING.

The cream should be brought to the right temperature for churning before being put in the churn by having it surrounded by cold water if the temperature needs to be lowered, and hot water if it needs to be raised. The churning should be done at as low a temperature as possible and have the "butter come" in a reasonable time, say from thirty to sixty minutes. The colder it is churned the less butter-fat will be left in the buttermilk and the more perfect will be the granules of butter. It is impossible to lay down any exact rule as to the right temperature; that will have to be determined by trial, each butter-maker for himself. Ordinarily from 58° to 62° F. is right, but sometimes it needs to be much lower and sometimes, possibly, a little higher. At the dairy tests at the World's Fair, in 1893, where expert butter-makers made every effort possible to do exhaustive work, the Guernsey cream was churned at times as low as 43°, while the cream from the other herds was churned 8° to 10° F. higher. The temperature at which cream should be churned depends in some degree on the breed of cows, the individuality of certain cows or of certain families of cows, the period of lactation, the feed of the cows, and, more than anything else, the thickness or richness of the cream. The temperature of churning needs to be higher when cows are in an advanced stage of lactation; also when they have dry feed in winter, and when cotton-seed meal is being fed to any extent. When cream is rich in butter-fat, such as can and ought to be obtained with the separator, containing from 30 to 35 per cent of fat, the temperature of churning can be low, usually from 52° to 55° F. This is the way to get the most exhaustive churning; the amount of buttermilk and the per cent of butter-fat in it will be small at these low temperatures. With deep cold-setting the cream

will be much thinner, containing considerable milk, and therefore the per cent of butter-fat low, and it will be useless to try to churn at a low temperature. In such cases from 60° to 62° will be necessary.

Cream from shallow setting, if it is skimmed pretty clear of milk, can be churned at a somewhat lower temperature than that from deep setting. Sometimes the cream from shallow setting, especially if the process of heating and cooling has been resorted to in raising the cream, is so thick that it will not fall when the churn is revolved. In that case it must be diluted. Water is better than milk to dilute it with.

The churn should be revolved at a speed that will produce the best concussion. With a 40-gallon box or barrel churn this will be about 50 revolutions per minute; with a smaller churn somewhat more speed is required. One can soon learn to tell by the sound when the cream begins to break. Then close watching is needed, so as not to churn it too much. The churn should be stopped when the granules of butter are somewhat smaller than wheat kernels. To make the butter float well, so that the buttermilk can be drawn off, throw in some salt, say one pint to each 20 gallons in the churn. Then revolve the churn a few times. Draw off the buttermilk through a hair sieve, so as to catch the granules of butter that escape from the churn. Then wash the butter with pure water at a temperature of 50° or below. This will harden the granules so they will not so quickly mass together. Wash it twice, each time using ten or twelve quarts of water to every 20 pounds of butter, and revolve the churn a few times. Do not wash it more, nor let the water stay on a great while at a time, for this will be likely to wash out the flavor and aroma, for which fine butter is prized.

The writer is well aware that this is contrary to the instructions given by many teachers on this subject. They advise washing more, saying that it should be washed till the water runs clear. But numerous experiments, where the butter has been submitted to the judgment of experts, seem to prove conclusively that the market yet demands some of the flavor that is found in butter which has not been excessively washed.

WHITE SPECKS IN BUTTER.

Mottles in butter and "white specks" are sometimes confounded, and by some are considered the same, but there is a difference. Mottled or streaky butter has been explained as being caused by an unequal distribution of the salt; but "white specks" have a different cause or causes. Sometimes, when the milk is set in shallow pans, they result from the cream drying on top, so there are small portions that are so hard they do not churn into butter. These particles do not take the color like the rest of the butter, and the "specks" are thus caused. This may be remedied by carefully straining the cream when it is put into the churn.

Another cause of "white specks" is this: When some milk is

skimmed off with the cream, as is usually done in the case of deep cold-setting, this milk settles to the bottom, gets overripe, and forms a curd, which will be so hard as not to break up in churning and will not run off with the buttermilk, but will remain with the butter as "white specks," or "flecks," as they are sometimes called. This can be remedied by not letting the cream stand so long before churning, or by frequent and thorough stirring of the cream during the process of ripening. These hard, white particles can also be taken out by straining the cream.

Mottled, streaked, or speckled butter will not sell well in market; therefore it is the part of wisdom to guard against such conditions.

COLORING BUTTER.

Butter should be colored to suit the person for whom it is intended. The general market demands that butter should have a color, the year round, about like that of grass butter in June. Doubtless any of the standard butter colors are good. The coloring matter should be put in the cream after it is all ready for the churn. When the butter would be nearly white if not colored, as is often the case in winter, about a teaspoonful of color is usually needed for 8 pounds of butter. In summer in times of drought and in the fall, when cows are partly on dry feed, some coloring may be needed, but very little. One will soon learn by experience how much to use. It is well to be cautious, as it is better to have too little color than too much.

SALTING AND WORKING BUTTER.

Good, fine dairy salt should be used, and never the common coarse barrel salt that is used by many. The salting may be done in the churn when the butter is in the granular form, if it is a box or barrel churn. The salt can be sifted on the butter by putting on a part, then revolving the churn halfway over, thus making the butter fall with the salted side down, then sifting on the rest of the salt. Then revolve the churn a few times, after which the butter can be taken out and worked on a butter worker. This is the way most commonly done, but it has its difficulties. The trouble is to have just the right amount of salt in the butter when it is finished, so as to have the product perfectly uniform as to saltness. The exact weight of the butter in the churn is not known, though this can be closely estimated, but it is impossible to tell how much water the butter contains, while in its granular state. This water must be all salted, and a portion of it will run off in the form of brine when the butter is worked. The finished butter should contain about three-fifths of an ounce of salt to the pound. To insure that amount, at least an ounce and a half of salt must be put in for each pound of butter in the churn, and yet, do the best we can, it will be found that two successive churnings are seldom salted just alike.

The writer has found that a better way to insure uniform salting is to

take the butter out of the churn, drain and press out a part of the water on the worker, then weigh the butter, and salt one ounce to the pound and work enough to get the salt evenly incorporated. Some more water or brine will run off in the working and leave the butter salted about right. In this way it will be found that one churning will be salted very nearly like every other churning.

There are several different kinds of butter-workers used by dairymen, but in the opinion of the writer none are better for home use than the common lever pattern.

SHALL BUTTER BE WORKED ONCE OR TWICE?

The object of working butter is to get the salt evenly distributed and to expel a portion of the brine. When it is worked but once, the butter-maker thinks he has worked the butter enough and packs it immediately. There is, at that time, no way to tell whether the salt has been evenly distributed or not. A few hours afterwards he draws out some of the butter with a trier, or cuts it with a ladle, and finds it mottled, which will seriously affect the selling price. He knows the cause is unequal salting; that the portions which have salt have changed to a deeper yellow, and the unsalted portions have remained of a lighter color. With the next churning he is determined to remedy this and be sure to work enough. The chances are that this time it is worked too much, so that the grain is injured and the butter has a greasy appearance. But after much practice and the exercise of good judgment and care, these errors can be avoided to a great extent, and a fairly uniform and even product produced.

In the opinion of the writer it is better to work butter twice instead of only once. The first time it should be worked just enough to mix in the salt. Then for four or six hours it should be left on the worker, or in some other place, where the temperature is from 60° to 65° F., so that the butter will remain in the right condition as to hardness to work well. This will give time for the salt to dissolve and also time for it to change the color of the butter that it comes in contact with. Then it should be worked just enough to obliterate the streaks and mottles. This second working expels some more of the water, for the salt has had time to draw the moisture together in drops, and it is worked out, thus making a drier butter containing from 85 to 87 per cent of butter-fat. Such butter will be firmer and better and more satisfactory to the consumer than it usually is when worked but once. Immediately after the butter is worked, it should be packed in neat, clean packages, or put up in such form as is required by the market to which it is to be sent. If tubs are to be used, ash or spruce is to be preferred, and they should be well soaked before packing the butter. If other wooden packages are used they should be lined with parchment paper. This will prevent the butter tasting of the wood.

MAKE BUTTER TO SUIT THE CONSUMER.

One thing should always be borne in mind by the person who is making butter to sell. The butter is for somebody else to eat, and it is for your interest to make it to suit them, whether it just suits your taste or not. Habit has a great deal to do with our likes and dislikes. You may have been accustomed to sweet-cream butter; if so, you probably like that best. Or, you may have got used to eating butter made from very ripe cream, and the butter not washed to expel the buttermilk, causing it to have a very decided flavor and taste, and so you look upon fine, delicate-flavored butter as insipid. Or you may like little or no salting or high salting; light color or high color. But all this is of no consequence. It is no matter what you like. You want to make it to suit your customer, and you want your customers to be those who are able and willing to pay a good price for what suits them. If the customer wants sweet-cream butter, make it; if unsalted, make it so; if he desires it high salted, salt it high, and so on. Always make it the same for the same customers. They are getting tastes formed which you can make it profitable to gratify. It is not the province of the maker of dairy butter to try and educate the tastes of people who buy butter, but rather to cater to their tastes when he finds out what they are. If one is making butter to put on the general market, he wants to make what that market demands and will pay the best price for. The best way to learn the market demand is to have the butter inspected by an expert judge who is a dealer and knows what takes best in the market. Ask him to criticise it and tell you just what he thinks of it; and don't get angry at what he tells you, but try and profit by what he says. The object of this article is to help farmers to make such butter as the best paying customers in the general market demand.

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SIR: I have the honor to transmit herewith copy for a revised edition of Farmers' Bulletin No. 57, Butter Making on the Farm, prepared under the supervision of the Chief of the Dairy Division of this Bureau by C. P. Goodrich, Dairy Instructor, Farmers' Institute Department, University of Wisconsin. This bulletin was originally prepared in 1897 and has several times been reprinted. The revision of the bulletin brings it up to date and makes it still more valuable for popular distribution. As the title indicates, the bulletin is designed for use on the farm rather than for those engaged extensively and exclusively in dairying.

Very respectfully,

D. E. SALMON,
Chief Bureau of Animal Industry.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	3
Good milk	3
Creaming the milk	4
Shallow setting	5
Deep cold-setting	6
The farm separator	7
Care and treatment of cream	9
Care of cream before ripening	9
Ripening cream	9
The starter, and how to prepare it	10
Use of the starter	11
Ripening temperatures	11
The degree of ripening	12
Alkaline tablets and their use for measuring acidity	12
The dairy thermometer	13
Making the butter	13
The churn	13
The care of the churn	14
Churning	14
Churning difficulties	15
White specks in butter	16
Coloring butter	17
Salting and working butter	17
Shall butter be worked once or twice?	18
Make butter to suit the customer	18

(Dairy, No. 15.)

BUTTER MAKING ON THE FARM.

INTRODUCTION.

As a matter of course, everyone who keeps cows for the purpose of making butter is desirous of making an article that will bring the best price possible, and of making the greatest amount of butter possible out of the milk produced. When the milk is delivered to a creamery it is usually manufactured by those who have been well instructed in the art of butter making, and the result is that, as a rule, a fairly good article is made. Besides this, the creamery is equipped with appliances which enable its butter maker to obtain very nearly all the butter contained in the milk; and, by his knowledge of what the general butter market demands, he is able to produce an article which is readily sold.

But the case is different with those who make butter on farms, where by far the greater part of the butter in this country is made. While on some farms excellent work is done and a choice article is made, which brings a fancy price, yet, through ignorance of correct methods of manufacture and of the demands of the market, and, in many instances, through careless and slovenly habits, the great bulk of farm-made butter fails to bring the price it should, entailing a loss on the farmers of the country which is enormous in the aggregate. It is for the benefit of the latter class that this article is written, with the hope that some suggestions may be given, and some ideas advanced, which will serve to improve the methods of the dairyman and increase his profits.

GOOD MILK.

To make good butter one must have good milk, and this comes only from healthy cows, fed on good sweet pasture or on good sweet grain and other forage, and which have pure water to drink and pure air to breathe. Certain obnoxious weeds—leeks, wild onions, ragweed, and others—give the milk and the butter made from it a decidedly bad flavor; so also do damaged or rotten silage, moldy corn fodder, or hay and musty, damaged grain. Impure water has its effect, both on the health of the animals and on the quality of the milk. In many pastures are seen small pools in which the cows stand during the heat of

the day to rid themselves of flies. The water in these becomes filthy and is kept stirred up by the movements of the cattle, and where, as is often the case, it is the only water obtainable, the cows are compelled to drink it. This can usually be avoided by fencing the pond and keeping the cattle out. If this water is needed for the cattle it can be drawn out by a pipe laid on the lower side into a trough from which the cows can drink.

In a close, crowded, and ill-ventilated stable, where there is too little air space for each animal, the air becomes foul from the exhalations, and this affects the milk as well as the health of the animals. The remedy in this case is to provide more room for the stock and better ventilation.

The stable should be kept as clean as possible and the cows well bedded and clean. The utmost cleanliness should be observed in milking. All dirt should be brushed from the cow before beginning to milk, and it is best to dampen the udder and flank of the cow, so as to prevent the dust and fine dirt from falling into the milk. The milk should be strained immediately after milking and not be allowed to stand in the cow stable any longer than is absolutely necessary.

A good strainer is indispensable, and one of cloth is much better than one of wire gauze. Milk pails should always be made of tin, and the seams should be soldered smooth, so that there will be no places for the dirt to lodge where it will be difficult to remove. They, as well as all other dairy utensils, should be cleaned thoroughly every time after using. Tin articles should be washed first in cool then in hot water, and after that scalded thoroughly with boiling water or steam. They should then be dried in fresh air and, if possible, in the sunlight. They will not need wiping after the scalding, as the heat from the boiling water will cause them to dry quickly. In washing them, if hot water is used first it will cook the milk onto the tin and make it difficult to remove.

In cleaning the butter bowl, ladle, worker, churn, and any other wooden utensil, they should be first washed with hot water, then scalded with boiling water or steam. They should be aired, but it will not do to have them much exposed to the sun, as that will cause warping and cracking.

CREAMING THE MILK.

When good, clean milk has been secured, the next operation is to separate the cream from the body of the milk. The old way, practiced by our mothers and our grandmothers, was to set the milk in shallow pans with the milk not more than 2 or 3 inches deep. The writer of this has been through all the successive stages of dairy methods. First, the milk was set in common 10-quart tin pans on shelves; then it was arranged so that in hot weather cold water flowed around the pans to keep the milk cool. After that, large shallow pans were used,

each one large enough to hold a single milking of the entire herd of 25 or 30 cows. Under these pans were water channels, through which in warm weather cold water was run, and in cold weather warm water, to regulate the temperature of the milk. Then the deep cold setting was used in both "shotgun" cans and Cooley cans, and finally, for the past ten years, the farm separator has been used.

SHALLOW SETTING.

It is undoubtedly true that by the old method of shallow setting as good a quality of butter was made and can yet be made as is produced by any other method, but it has its drawbacks. Uniformly good results can not be obtained, for the reason that the milk, being spread out in a thin sheet, is exposed to the air, so that it is readily affected by atmospheric changes. Whatever may be the reason, very bad effects often follow an electric storm, or thundershower. The shallow pans make more work than other methods; the creaming is not so thorough as with the separator, and, therefore, the quantity of butter is less.

As there are many persons who think they are so situated as to make any other method impracticable, or who have such a deep-seated prejudice in favor of the old way that they can not be induced to change, it is thought advisable to give directions as to the best manner of proceeding, as determined by the result of long years of practical experience, although the method itself is not recommended.

Milk should be set as soon as possible after being drawn from the cow, whether shallow or deep setting is used. With open setting it must be in a room where the air is pure. A pantry with a door opening into the kitchen is a bad place. The odor from cooking vegetables and meat will surely injure the butter. Many make butter in a cellar, because it is cool, but it is apt to impart a musty, moldy smell to the butter. A cellar may be good and cool and so ventilated as to have pure air; then it is all right for butter making. To get the best results with shallow setting, the temperature of the milk should not go much above 60° F. At that temperature it can usually stand about thirty-six hours. The time to skim is when the milk has soured just enough to be a little thick at the bottom of the pans and to thicken the cream. The cream can not be skimmed off when it is thin and sweet without loss. No milk should be taken with the cream. Cream with milk in it sours much more rapidly than cream with no milk in it. This cream will be very rich and thick, and, although partially ripened when taken off, if kept at a temperature of 60° or below, it will be all right to hold two or three days before churning. Whenever a new skimming is put into the cream jar or can, the whole should be thoroughly stirred and mixed.

In the winter effective creaming may be had when the room in which the milk is set is very cool, even down near the freezing point.

This is accomplished by heating the milk to above 100° F. before setting. The cream will rise very rapidly while the temperature is falling. The warming can be repeated after twelve hours, if the milk is in small pans, by setting over a kettle of boiling water. If large pans are used, such as have been described, the heating is done by running hot water through the water channels beneath the milk. This practice of repeated heating and cooling makes very effective creaming, leaving but little butter fat in the skimmed milk, and the cream is rich and thick.

DEEP COLD-SETTING.

With this method the milk is set in cans about 20 inches deep by 8 inches in diameter. It should be set in a tank of ice water as soon as possible after milking, while the milk is yet warm. The most effective creaming is done when the temperature of the water is maintained at about 40° F., though fairly good work is done when the water is even up to 50° F., if it is allowed to get no higher. When there is a fountain or flowing well or running stream of water continually flowing into and out of the tank, so that the water is constantly being changed around the cans, the warm milk will be more rapidly cooled and the cream will rise more rapidly than if the water is at rest. For this reason cool springs, spring pools, and spring houses are very satisfactory, even if the water is up to 53° or 54° F.; and deep stone jars or milk crocks may be used as well as deep tin cans. It is claimed that with this mode of setting all the cream that can be obtained will be up in ten or twelve hours. This may be so, though it is doubtful. It is better to let it stand twenty-four hours, for the reason that the cream will be thicker and richer at the end of that time, though it may not measure any more, or even as much, in depth as it would after standing only twelve hours.

Setting the cans in cold air will not prove nearly as effective in raising the cream as setting them in cold water, even though the temperature of the surrounding air is near the freezing point.

With the jars, crocks, and the common "shotgun" cans, as they are called, the skimming is done by dipping the cream from the top, but with the Cooley cans and many other creamers it is done by drawing the milk off from the bottom and leaving the cream. There is a strip of glass inserted in the side of most of these cans, so that the depth of the cream can be seen. With deep cold-setting the cream is always sweet and thin, and where the skimming is done from the top it requires a great deal of skill to dip the cream off without getting some of it mixed with the milk and lost. Much more cream and, consequently, butter, is lost in this way than is even dreamed of by those who practice it. A conical, or pointed, dipper is the best kind of skimmer for this work. In using it insert the point of the skimmer in the middle of the can and press it down very gently till the cream slowly runs over

into it. When it is filled carefully lift it out and empty it; then put it into the can in the same place as before—that is, in the middle—and repeat the operation till the cream is all off. This work should be done very carefully, so as not to create any commotion in the milk; but even with the best of care some of the cream will get mixed with the milk and lost. Much the best way is to skim by means of a faucet, drawing off the milk rather slowly at the bottom so as not to create currents in the milk, and leave about one-half an inch of milk under the cream.

THE FARM SEPARATOR.

By the use of the cream separator a much more perfect separation of the cream from the milk may be had than by any system of setting milk. This is shown by the increased amount of butter made when the separator is used, and also by the amount of butter fat left in the milk after skimming, as shown by the Babcock milk test. It has been found that by no system of gravity creaming can all the butter fat be recovered; and usually, under ordinary conditions, a large per cent is lost; but with the separator very nearly all is recovered.

The writer has been engaged in the farmers' institute work in the State of Wisconsin, during each winter, for several years. At each meeting milk was tested with a Babcock tester which was carried along for the purpose. Farmers were invited to bring in samples of milk to be tested in order to show them the variations in value of different milks, and for the purpose of illustrating and explaining the working of the machine. They were especially urged to bring in samples of skimmed milk—milk which they thought had been thoroughly creamed—so that the audience might see what the loss was. For two years the writer preserved the report of these tests and the average of all was eight-tenths of 1 per cent butter fat for the skimmed milk creamed by any gravity method. It varied from one-fourth of 1 per cent to $1\frac{6}{10}$ per cent. This was in the winter, when there was no difficulty in having the milk cold enough. There is no doubt that in summer, during hot weather, the average loss is still greater. If the separating is done on the farm immediately after the milking, the skimmed milk from the separator seldom tests more than one-tenth of 1 per cent butter fat, and frequently less than that.

From the result of these tests it seems impossible to escape the conclusion that the average loss, where the milk is set in pans, cans, and crocks, is three-fourths of a pound of butter more to each 100 pounds of milk than where the separator is used. This means, with milk of average richness (3.5 per cent butter fat), a loss of about 20 per cent of the total product of butter. A herd of cows ought to average, per cow, 5,000 pounds of milk per year, and will do so if made up of good animals and well managed; but even if they only average 3,000, the loss

on one cow will be 22½ pounds of butter, and on ten cows 225 pounds, which, at 20 cents a pound, will be $45 a year. It will be seen by this that the loss to the farmers who cream their own milk by a gravity process is enormous in the aggregate. How could any business man succeed and suffer such a percentage of loss? What would be thought of the man who would go on from year to year with a hole in his pocket through which 20 cents would drop out and be lost every time he put a dollar into his pocket. Some men try to console themselves by saying, "It is not all lost; the calves and pigs get the butter." But this is poor consolation, for butter is dear feed, even when the price is the lowest. A few cents' worth of oil meal will do the calves and pigs as much good as a pound of butter. Besides this, the skimmed milk from the separator, when it is run through and fed to them immediately after milking, while it is warm and sweet, is better feed for calves than skimmed milk that is old and partially sour, even though it does contain one-quarter of the butter fat originally in it. This can be attested by hundreds who are using farm separators.

The cost of hand separators is from $65 to $125 each, according to size and capacity. They will skim from 160 to 400 pounds an hour. Larger sizes with greater capacity are used in large dairies and run with some kind of a power. It would seem that no dairyman, who manufactures his own milk into butter, having ten cows or more, could afford to be without a separator. One, if properly cared for, will last for years. If turned by hand, it is true that it takes time, but not as much as would be taken in setting and skimming the milk and warming it for calves. All except the smallest size hand separators are so constructed that they can be attached to a power. Some use a small gasoline engine or steam engine. A light tread power run by a large dog or some other animal of like size is very economical. A goat has been found to do remarkably well.

On the farm of the writer a separator has been run for the past five years, making an average of nearly 9,000 pounds of butter a year. The cost of repairs in that time has been $3, and the separator, to all appearances, will last for several years to come. It has a capacity of 300 pounds of milk an hour. It is run by a two-horse tread power, which was purchased before the separator was, and which is used for cutting feed, filling silo, etc. The power is run by a Jersey bull, and works very nicely. He needs the exercise; it keeps him docile and gentle, vigorous and healthy, and he seems to enjoy the walking. The separating is done while the milking is going on, and ten or fifteen minutes after the last cow is milked the calves and pigs have had the warm sweet skimmed milk. The saving by the use of the separator on this farm has been already a great many times more than the cost of the outfit.

CARE AND TREATMENT OF CREAM.

In many instances in the farm dairy it is not convenient or practical to churn oftener than two or three times during the week. As a consequence, some of the cream for a churning must be held two or three days.

CARE OF CREAM BEFORE RIPENING.

In the case of cream from shallow setting, which is comparatively warm and probably thick and partly ripened when taken off, it should be kept as cold as possible, in order to prevent it from becoming excessively ripe. Unless this is carefully attended to, the result is likely to be that all the butter of the churning will have a sour taste, and in some cases will be unmarketable. When each new skimming is added to the cream vessel, the whole mass should be thoroughly mixed by stirring; this will keep the cream homogeneous and prevent any inequality in ripening.

When the milk is creamed by the deep-setting or by the centrifugal process, it is comparatively cold and still sweet, and it is therefore an easy matter to keep it sweet for two or three days or until enough cream for a churning is gathered. Each new lot of separator cream should be thoroughly cooled before it is mixed with that already collected. The cream vessel may then be set in any creamer, or ice-water tank, in case the deep-setting system or the separator system is used, or may be hung tightly covered in a well or cistern.

RIPENING CREAM.

Upon the ripening of the cream, more than any other single step in the process of butter making, depends one's success or failure as a butter maker: for, not only is the essential attribute of flavor dependent upon the ripening, but the exhaustiveness of the churning, or the relative loss of fat in buttermilk, is also influenced in a large degree by the ripening. In order to ripen cream satisfactorily, the butter maker should thoroughly understand the principles involved and, further, he must be provided with certain equipment now considered almost essential to successful butter making.

The principles of cream ripening may be briefly stated as follows: Cream is ripened by bacteria of the lactic acid group acting upon the milk sugar and converting it into lactic acid. By this bacterial action the desired butter flavors, so much sought for, are evolved. It is generally held that the maximum amount of flavor that can be safely produced is reached when the cream has developed about six-tenths of 1 per cent of acid. It makes but little, if any, difference whether this amount is developed in six hours or in forty-eight. The rapidity with which the cream will ripen depends upon three conditions—the number of ripening bacteria present in the cream at the beginning of the

ripening period, the number added in the "starter," and the temperature at which the cream is held during ripening.

No one can tell, even in a general way, how many ripening bacteria a given cream may contain, but we do know that there are more present in all dairy products during hot weather than during cold weather. Hence, at a given temperature, cream will ripen faster, other things being equal, in the summer than in the winter time. In order to ripen cream as fast in cold weather as in hot, it is not only necessary to ripen at a higher temperature, to insure a more rapid growth of the bacteria, but it may also be necessary to add ripening bacteria to the cream in a "starter," for the same reason that the housewife puts yeast into the bread to start it to rise.

THE STARTER AND HOW TO PREPARE IT.

A starter is nothing more nor less than a comparatively small quantity of skimmed milk, cream, or buttermilk in which practically pure lactic acid bacteria have developed. It may be made in the following manner: A fresh, healthy cow is selected for the source of the milk. Before milking care is taken that no dust is stirred up in the stable, and the udder, belly, flanks, and legs of the cow are brushed and then moistened to prevent any loose hairs or particles of dirt from falling into the milk pail; then the first few streams of milk from each teat are rejected. The milk is drawn into a vessel that has been most thoroughly scalded and then cooled, and which is loosely covered, so as to prevent the possibility of any dust falling into it. In milking the vessel should be held as close to the animal as convenient to keep dust from getting into the milk. When the milking is complete the vessel, loosely covered, is set in a cool, well-ventilated, clean place in order that the cream may rise. In from twelve to eighteen hours the milk may be skimmed by carefully dipping off the cream with a small dipper that has been thoroughly scalded and cooled just before being used. The skimmed milk in the vessel should then be warmed to 85° and held at this temperature until thick, when it should be put in a cool place, like the cellar bottom, until ready for use. Just before using two inches should be taken off the top and thrown away, as this is not considered as good or pure as the remainder. A starter is best propagated by selecting a small amount of the best skimmed milk available, putting it into a can that may be loosely covered, and pasteurizing it by setting the can into water heated to 180°, and stirring occasionally for an hour. The can should then be put in cold water, with an occasional stirring, and held until the skimmed milk has reached a temperature of about 85°. To this should be added a portion of the starter already made, provided it still has a clean, sharp, sour taste. The proportions should be one part (or pint) of the

starter to five parts (or pints) of the pasteurized skimmed milk thus prepared; the new mixture should then be kept at a temperature of 85° to 95° until it has thickened, when it, in turn, is put in a cool place until wanted for use. Two inches of the top should be removed and rejected as before when it is to be used.

If all conditions are favorable, each succeeding new starter should be better than the preceding one, inasmuch as it should be purer and, in time, if properly handled, should contain no bacteria other than those belonging to the group that forms lactic acid. The writer once met a butter maker in Holland who had kept his starter in this way without a break for seven years.

USE OF THE STARTER.

The amount of starter to be used depends upon four main conditions—the season of the year, the percentage of fat in the cream, the temperature at which the cream is to be ripened, and the condition of the cream when the starter is added. If the starter is what it should be, it is best always to add as much as the cream will take within the limits of reason. Rich cream needs more starter than poor cream, other things being equal; more starter can be used in perfectly sweet cream than in cream that is beginning to sour; more starter is generally needed in the winter, and more is also needed when the cream is to be ripened at a low than at a high temperature. When the weather is warm and the cream not perfectly fresh, not more than 2 to 5 per cent should be used, but, with a rich fresh cream in winter, as much as 20 per cent can be used to advantage. The starter should be added to the cream by straining it through two layers of fine cheese cloth, and mixed in by stirring gently but thoroughly for three or four minutes. The constant use of a starter in ripening cream has two other advantages which have not yet been mentioned. One is that the starter, containing as it does a large number of a particular kind of bacteria, has a tendency to subdue or choke out any undesirable bacteria that may be present in the cream at the beginning of ripening. The other is that the constant use of a carefully selected starter is certain to produce a more uniform flavor through the year than it is possible to obtain without its use.

Never use a starter without first carefully examining it. If it has an unpleasant taste or smell, do not use it under any circumstances. A bad starter is worse than none at all.

RIPENING TEMPERATURES.

The ripening temperature also varies with various conditions. It makes but little difference in the results obtained whether the cream

is ripened quickly at a temperature of 65° or is ripened slowly at a temperature of 55°. Hence the best ripening temperature is that which will have the cream ripe at the time most convenient for the butter maker. If the cream is of medium thickness, it is often most convenient to ripen it at the churning temperature, which may be from 52° to 58°. This will obviate the necessity of cooling the cream down after it is ripened and before it is churned. The ripening temperature, then, is largely one of convenience and must be determined by the individual butter maker. In most cases, however, the lower temperature is to be preferred, as there is less danger of the cream being ruined by overripeness than by a high temperature. It is quite an easy matter to maintain an even ripening temperature in cold weather by putting the cream bucket, pail, or crock into a wooden tub or vessel containing water two or three degrees warmer than the ripening temperature desired. In warm weather the process must be reversed and colder water used. By occasionally stirring the water in the tub, as well as the cream, and, whenever necessary adding either warmer or colder water, the temperature can be maintained quite uniform throughout the process of ripening.

THE DEGREE OF RIPENING.

The best and most uniform results are obtained only when each churning of cream is ripened to a definite and fixed degree of acidity. This degree of ripeness will vary somewhat in individual cases, but for table butter cream ripened to contain about six-tenths of 1 per cent of acid will generally be satisfactory. While cream ripened to this extent will ordinarily have a characteristic appearance, it is impossible to tell by appearance alone when the desired point has been reached; hence some other and more definite means must be employed.

ALKALINE TABLETS AND THEIR USE FOR MEASURING ACIDITY.

The simplest, cheapest, and most convenient measure that the butter maker can use to determine the amount of acid the cream contains at any stage of the ripening process is an alkaline tablet.

These are small lozenges, or troches, containing a definite amount of alkali and a little pink coloring matter; when dissolved in a certain amount of water they give an alkaline solution of a definite strength. This solution is used to determine the acidity of milk or cream, either in testing the ripeness for churning or to ascertain the condition of milk or cream destined for market.

A small, complete outfit may be had from any dairy supply house for 85 cents and a larger one for $2.75. Full directions accompany

each outfit. Its use is easily acquired and its adoption by butter makers can not be too strongly urged, as it aids very materially in producing a uniform quality of butter.

THE DAIRY THERMOMETER.

In this age of progress, when so much is known concerning the influence of temperature upon the quality of butter, no butter maker who aims at the production of a uniformly high grade of butter will fail to use an accurate thermometer regularly in his daily work.

Floating dairy thermometers cost but 25 cents and last a long time if carefully used. When purchasing, however, care should be taken to see that they are compared with a standard thermometer and that they are fairly correct.

It is safe to assume that the dairyman who faithfully and conscientiously uses a thermometer and an acid measure in ripening his cream will not lack in the other essentials of a successful butter maker.

MAKING THE BUTTER.

THE CHURN.

Of all the various styles of churn that at one time or another have been put before the dairy world, it may be said that none will make more or better butter under good conditions than the old dasher churn familiar to our grandmothers and great-grandmothers. This is far from saying, however, that the churn has not been improved in matters of ease and convenience of operation.

For the farm dairy, where the temperature often gets beyond control, and where it is impossible to work butter without its becoming soft and greasy, the dairy size of the combined churn and worker will prove of great assistance in making good butter. This machine churns and works the butter without exposing it to the temperature of the churn room, and makes a firm butter, ready for packing, even when the temperature surrounding the churn is 80°. The churn and worker combined costs no more than the two implements of equal capacity separate, and is cleaner and much more convenient. It is essential that the size of the churn used be adapted to the dairy. A churn too small is almost useless and one too large is no better. For the most satisfactory results the cream should fill the churn from one-third to one-half full. A churn over half full does not give room for enough concussion to bring butter within a reasonable length of time, and in a churn less than one-third full the cream will frequently spread out on the inside and "ride" without churning at all.

THE CARE OF THE CHURN.

To prepare it for use, the churn should be thoroughly scalded to close up the pores of the wood and to wash out any dust that may be in it. Care should be taken, while using the hot water, to see that the churn cover is not fastened tight and that the steam is allowed to escape after each of the first few revolutions. Otherwise the steam which accumulates while the churn is being washed may blow the cover off and ruin the churn. After hot water is used, the churn should be cooled with cold water. It is then ready for the cream. In cleaning the churn after using, it is seldom necessary to do more than wash it thoroughly with hot water; then it should be thoroughly dried in pure air. During the intervals between churnings, the churn should not be shut up tight and stored away in the dark, but rather kept in a light, cool, airy place and the opening covered with a layer of clean cheese cloth.

CHURNING.

The cream should be brought to the right temperature for churning before being put in the churn by having it surrounded by cold water if the temperature needs to be lowered, and hot water if it needs to be raised. The churning should be done at as low a temperature as is consistent with having the butter "come" in a reasonable time, say from thirty to sixty minutes. The colder it is churned the less butter fat will be left in the buttermilk and the more perfect will be the granules of butter. It is impossible to lay down any exact rule as to the right temperature; that will have to be determined by trial, each butter maker for himself. Ordinarily from 58° to 62° F. is right, but sometimes it needs to be much lower and sometimes, possibly, a little higher. At the dairy tests at the World's Fair, in 1893, where expert butter makers made every effort possible to do exhaustive work, at times the Guernsey cream was churned as low as 43° F., while the cream from the other herds was churned 8° to 10° higher. The temperature at which cream should be churned depends in some measure on the breed of cows, the individuality of certain cows or of certain families of cows, the period of lactation, the feed of the cows, and, more than anything else, the thickness or richness of the cream. The temperature for churning needs to be higher when cows are in an advanced stage of lactation; also when they have dry feed in winter, and when cotton-seed meal is fed to any extent. When cream is rich in butter fat, as it should be when a separator is used, containing from 30 to 35 per cent of fat, the temperature of churning can be low, usually from 52° to 55° F. This is the way to get the most exhaustive churning; the amount of buttermilk and the percentage of butter fat in it will be

small at these low temperatures. With deep cold-setting the cream will be much thinner, containing considerable milk, and therefore the percentage of butter fat will be low, and it will be useless to try to churn at a low temperature. In such cases from 60° to 62° will be necessary.

Cream from shallow-setting, if it is skimmed pretty clear of milk, can be churned at a somewhat lower temperature than that from deep-setting. Sometimes the cream from shallow-setting, especially if the process of heating and cooling has been resorted to in raising the cream, is so thick that it will not fall when the churn is revolved. In that case it must be diluted. Water is better than milk to dilute it with.

The churn should be revolved at a speed that will produce the best concussion. With a 40-gallon box or barrel churn this will be about 50 revolutions per minute; with a smaller churn somewhat more speed is required. One can soon learn to tell by the sound when the cream begins to break. Then close watching is needed, so as not to churn it too much. The churn should be stopped when the granules of butter are somewhat smaller than wheat kernels. To make the butter float well, so that the buttermilk can be drawn off, throw in some salt, say one pint to each 20 gallons in the churn. Then revolve the churn a few times. Draw off the buttermilk through a hair sieve, so as to catch the granules of butter that escape from the churn. Then wash the butter with pure water at a temperature 3° to 5° lower than the churning temperature. This will harden the granules so they will not so quickly mass together. Wash it twice, each time using enough water to float the butter nicely, and revolve the churn a few times. Do not wash it more, nor let the water stay on a great while at a time, for this will be likely to wash out the flavor and aroma, for which fine butter is prized.

The writer is well aware that this is contrary to the instructions given by many teachers on this subject. They advise washing more, saying that it should be washed till the water runs clear. But numerous experiments, where the butter has been submitted to the judgment of experts, seem to prove conclusively that the market yet demands some of the flavor that is found in butter which has not been excessively washed.

CHURNING DIFFICULTIES.

The difficulties incident to churning are due almost entirely either to unsuitable temperature or to insufficient agitation.

When cream swells in churning and the butter fails to come it is an indication that the churning temperature is too low or that the cream is too thin. The remedy in such cases is to remove about half of the cream from the churn to insure an abundant agitation of what remains,

and then warm the cream to 68° or 70° F. and hold it there for an hour, by moving about or floating in it a can or pail nearly filled with water heated to a temperature of about 100°. The butter will then usually come without any difficulty. Repeat the operation with the half of the churning which was removed. Never warm cream under the above conditions by pouring hot water directly into it. This usually tends to make a bad matter worse.

With revolving churns a difficulty likely to occur where a small amount of thick cream is to be churned is that, just before the cream is ready to break, it will stick to the sides of the churn and ride around without churning at all. Sometimes this can be remedied by revolving the churn so slowly that the cream at the highest point in the churn will drop to the lowest, thus insuring the coming of the butter. In other cases the difficulty can be overcome only by diluting the cream with a little weak brine at the same temperature as the cream.

In the winter, when the churning temperature is apt to be a little low, the butter will frequently come in small round shot-like granules. As such butter is difficult to salt uniformly, the conditions producing it are to be avoided. A higher churning temperature or a richer well-ripened cream will insure the butter coming in the flaky granules so much desired.

WHITE SPECKS IN BUTTER.

Mottles in butter and "white specks" are sometimes confounded, and by some are considered the same, but there is a difference. Mottled or streaky butter has been explained as being caused by an unequal distribution of the salt; but white specks have a different cause or causes. Sometimes, when the milk is set in shallow pans, the cream dries on top and small portions become so hard that they do not churn into butter. These particles do not take the color like the rest of the butter, and the specks are thus caused. This may be remedied by carefully straining the cream when it is put into the churn.

Another cause of white specks is this: When some milk is skimmed off with the cream, as is usually done in the case of deep cold-setting, this milk settles to the bottom, gets overripe, and forms a curd, which is so hard as not to break up in churning and will not run off with the buttermilk, but will remain with the butter as white specks, or flecks, as they are sometimes called. This can be remedied by not letting the cream stand so long before churning or by frequent and thorough stirring of the cream during the process of ripening. These hard, white particles can also be taken out by straining the cream.

Mottled, streaked, or speckled butter will not sell well in market; therefore it is the part of wisdom to guard against such conditions.

COLORING BUTTER.

Butter should be colored to suit the person for whom it is intended. The general market demands that butter should have a color, the year round, about like that of grass butter in June. Doubtless any of the standard butter colors are good. The coloring matter should be put in the cream after it is all ready for the churn. When the butter would be nearly white if not colored, as is often the case in winter, about a teaspoonful of color is usually needed for 8 pounds of butter. In summer in times of drought and in the fall, when cows are partly on dry feed, some coloring may be needed, but very little. One will soon learn by experience how much to use. It is well to be cautious, as it is better to have too little color than too much.

SALTING AND WORKING BUTTER.

Good fine dairy salt should be used, and never the common coarse barrel salt that is used by many. The salting may be done in the churn when the butter is in the granular form, if it is a box or barrel churn. The salt can be sifted on the butter by putting on a part, then revolving the churn halfway over, thus making the butter fall with the salted side down, then sifting on the rest of the salt. Then revolve the churn a few times, after which the butter can be taken out and worked on a butter worker. This is the method most commonly followed, but it has its difficulties. The object is to have just the right amount of salt in the butter when it is finished and the product perfectly uniform as to saltness. The exact weight of the butter in the churn is not known, though this can be closely estimated, but it is impossible to tell how much water the butter contains while in its granular state. This water must all be salted, and a portion of the salt will run off in the form of brine when the butter is worked. The finished butter should contain about three-fifths of an ounce of salt to the pound. To insure that amount, at least an ounce and a half of salt must be put in for each pound of butter in the churn; and yet, do the best we can, it will seldom be found that two successive churnings are salted just alike.

The writer has found that a better way to insure uniform salting is to take the butter out of the churn, drain and press out a part of the water on the worker, then weigh the butter, use 1 ounce of salt to the pound, and work enough to get the salt evenly incorporated. Some brine will run off in the working and leave the butter salted about right. In this way it will be found that one churning will be salted very nearly like every other churning.

There are several different kinds of butter workers used by dairymen, but in the opinion of the writer none are better for home use than the common lever pattern.

SHALL BUTTER BE WORKED ONCE OR TWICE?

The object of working butter is to get the salt evenly distributed and to expel a portion of the brine. When it is worked but once, the butter maker thinks he has worked the butter enough and packs it immediately. There is at that time no way to tell whether or not the salt has been evenly distributed. A few hours afterwards he draws out some of the butter with a trier, or cuts it with a ladle, and finds it mottled, which will seriously affect the selling price. He knows the cause is unequal salting, the portions salted having changed to a deeper yellow, while the unsalted portions have remained of a lighter color. With the next churning he is determined to remedy this and be sure to work enough. The chances are that this time it will be worked too much, so that the grain is injured and the butter has a greasy appearance. But after much practice and the exercise of judgment and care these errors can be avoided to a great extent, and a fairly uniform and even product produced.

In the opinion of the writer it is better to work butter twice than only once. The first time it should be worked just enough to mix in the salt. Then for four to six hours it should be left on the worker, or in some other place, where the temperature is from 60° to 65° F., so that the butter will remain in the right condition as to hardness to work well. This will give time for the salt to dissolve and also time for it to change the color of the butter that it comes in contact with. Then it should be worked just enough to obliterate the streaks and mottles. This second working expels some more of the water, for the salt has had time to draw the moisture together in drops, and it is worked out, thus making a drier butter containing from 85 to 87 per cent of butter fat. Such butter will be firmer and better and more satisfactory to the consumer than it usually is when worked but once. Immediately after the butter is worked it should be packed in neat, clean receptacles or put up in such form as is required by the market to which it is to be sent. If tubs are to be used, ash or spruce is to be preferred, and they should be well soaked before packing the butter. If other wooden receptacles are used, they should be lined with parchment paper. This will prevent the butter tasting of the wood.

MAKE BUTTER TO SUIT THE CONSUMER.

One thing should always be borne in mind by the person who is making butter to sell. The butter is for others to eat, and it is for your interest to make it to suit them, whether it just suits your taste or not. Habit has a great deal to do with our likes and dislikes. You may have been accustomed to sweet-cream butter; if so, you probably like that best. Or, you may have become used to eating butter

made from very ripe cream and butter not washed to expel the buttermilk, causing it to have a very decided taste, and so you look upon fine, delicately flavored butter as insipid. Or you may like little or no salting, or high salting; light color, or high color. But all this is of no consequence. It is no matter what you like. You want to make it to suit your customers, and you want your customers to be those who are able and willing to pay a good price for what suits them. If a customer wants sweet-cream butter, make it; if unsalted, make it so; if he desires it highly salted, salt it highly, and so on. Always make it the same for the same customers. They are getting tastes formed which you can make it profitable to gratify. It is not the province of the maker of dairy butter to try to educate the tastes of people who buy butter, but rather to cater to their tastes when he finds out what they are. If one is making butter to put on the general market, he wants to make what that market demands and will pay the best price for. The best way to learn the market demand is to have the butter inspected by an expert judge who is a dealer and knows what takes best in the market. Ask him to criticize it and tell you just what he thinks of it; and don't get angry at what he tells you, but try to profit by what he says. The object of this bulletin is to help farmers to make such butter as the best-paying customers in the general market demand.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number and title of each. Copies will be sent free to any address in the United States on application to a Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. Numbers omitted have been discontinued, being superseded by later bulletins.

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